Ventilator Tip Sheet

COVID-19 Vent Tip Sheet

Version 4
Updated 7/14/2020
Changes in BOLDness

Lifespans

COVID-19: COVID-19 Provider Information
Airway Management Algorithm
Ventilator Management Protocol
Oxygenation
Therapeutic Management

Pre-intubation Considerations

Awake intubation prone has some anecdotal evidence. Early intubation recommended for clinical worsening or escalating oxygen requirements, especially once on NIPPV (non-invasive positive pressure ventilation) or high flow nasal oxygen (HFNC) > 15 L/min with rising requirements.

ARDS – Acute Respiratory Distress Syndrome

• Diagnosis = acute hypoxia with bilateral infiltrates on imaging setting in pO2 to FiO2 ratio <300 not fully explained by cardiac failure. Management focuses on oxygenating while reducing risks of ventilator induced lung injury (VILI) by minimizing tidal volumes, airway pressure, and FiO2 while using higher PEEP and deeper sedation or paralytics to maintain vent synchrony.

Ventilator Basics – Goal is to Oxygenate and Ventilate

• Minute ventilation (MV) = Respiratory Rate per minute (RR) x Tidal volume (TV)
  • This equation determines ventilation, and increasing MV will allow for more pCO2 removal, which is key for RR to maintain same MV.
  • Monitoring blood gases 15-30 minutes after ventilator change can aid in management. Normal MV range from 4-12 depending on clinical status.

• Oxygenation
  • Goal pulse ox >92%
  • Oxygenation can be improved by increasing positive end expiratory pressure (PEEP) and FiO2 as needed. In setting of ARDS, would favor using a PEEP strategy initially, with increasing PEEP and FiO2 per ARDSnet protocol to obtain goal sat. However if ineffective, a subset of COVID patients appear to oxygenate better on a low pO2/high FiO2 setting.
  • Recruitment maneuvers – places patient on continuous pressure (often 30 cm H2O) for a set time (30-45 seconds) to recruit alveoli to improve oxygenation. Can be used as “rescue” when not meeting oxygenation goals but if repeating should then move to other methods such as pCO2, prone, Inhaled nitric oxide, etc.

• Ventilator Modes – in ARDS, control mode is recommended. In this institution, we generally avoid volume modes, however volume control with inspiratory hold is appropriate in some cases.
  • Pressure-limited assisted control (PC) – Set the minimum RR, PEEP, and target inspiratory pressure (= pressure over PEEP, ΔP, or “delta”)
  • Vent will deliver set pressure and patient’s compliance will determine a dependent volume. Patient can breath faster than set RR if needed. To be monitored for changes in volumes (such as increasing TV as compliance improves in ARDS) that would require change in delta.

• Pressure support (PS) – Set the FiO2, PEEP, and ΔP, patient will determine their MV based on their compliance and RR.
  • Best ventilator mode for lightly sedated patients requiring minimal support.
  • Improves synchrony and comfort, however requires more patient effort.

• Tidal Volume Goals – ARDS, target TV of 6-8 cc/kg of ideal body weight (dependent on sex and height, not actual weight) which is called low tidal volume ventilation (LTV) with mortality benefit.

• Lung compliance determines how much pressure is required to reach a certain TV. Vent dysynchrony can make consistent TV difficult, in which case would increase sedation and consider paralytics. Be careful to monitor peak pressure (the pressure at end inspiration without flow), which should be <30 cm H2O and often limits our TV and MV.

• Once plateau pressures >30, decrease TV by 1 ml/ideal body weight down to 4 ml/kg IBW if needed.

• PEEP – This maintains pressure at alveolar level as patient exhales, which keeps recruited alveoli open. Require higher PEEPs, in some cases up to 20-24 cm H2O, to maintain oxygenation in ARDS, though some COVID patients appear to do better at low PEEPs (5-8). Minimum PEEP is 5 cm H2O.

• RR – Generally set at 12 to 16 breaths/minute initially unless significant hypercapnia. If not breathing spontaneously, rate should be driven to maintain CO2 levels within normal range (40-50 mm Hg) with intra-surgery, usually between 20-25 breaths/minute. This is not set to mirror peak expiratory flows (PEF).

• Sedation – Often treating pain, delirium and agitation with multiple agents. Managed as step-up, step-down therapy, goal to have calm and responsive patient but similarly need to ensure enough sedation for patient comfort and safety from related complications.

• Extubation
  • Majority of COVID-19 patients appear to wean more slowly over course of weeks
  • Common causes are fluid overload (diurease), airway resistance (ETT too small for spontaneous breath trial (SBT)), new pneumonia (work-up and treat), wong VM matching (patient will start alternating breaths), or severe respirator (ex. Amiodarone), wheezing (increase bronchodilators), poor lung nutrition and weakness (ensure tube feeds, electrole up intake), and neuromuscular disease (myasthenia gravis, critical care myopathy, overdosed).

• Generally recommend trach extubation for patients on vent for 14 days or more, however need to consider lung term potential for recovery and goals of care in setting before trach extubation, and current guidelines for trach extubation in COVID-19 unclear.

When to Consider Referral For Extra-corporal Life Support (ECLS)

• Currently can provide ECMO (extracorporeal O2 and potentially hemodynamic support) and ECCOR (extracorporeal CO removal), though limited circuits available. Consult the MCI attending or ICU attending. Would like patient considered, data show early consideration (within days of ARDS) better for outcomes.

When To Consider Exubation – There is no hard-and-fast rule for when to extubate.

• General, patient with improved underlying pathophysiology with spontaneous breathing efforts (not on non-invasive or continuous positive pressure) or high flow nasal cannula (HFNC), would favor extubation. Goal to have patient ventilated for <15 hours in HFNC, so should tolerate PS at 5 with FiO2 ≤ 25%

• Daily SBT and Spontaneous Awakening Trials (SAT)
  • These should be done daily and usually together, exceptions being those patients that are in severe ARDS, paralyzed, or require sedation for other purposes (like benzogit for status epilepticus). SBT generally is PS with delta of 5 and PEEP of 5 (“over s”) and FiO2 ≤ 50% with sedation turned off or minimized. Obese patients may need a R/A.

• Other things to consider – Are tracheal secretions manageable off vent? Is mental status improved enough to protect airway once extubated? Do they have a sufficient cough? Can they generate significant inspiratory force without positive pressure (i.e. PEEP)?

• Is the airway itself safe for extubation (i.e. angioedema, etc)? Are they candidate for rescue therapy such as NIPPV or HFNC if they fail? Would patient want to be reintubated for falls extubation?

Important Orders for Ventilated Patients – name of order in parentheses.

• General Adult Ventilator Management – An order set which includes NPO, constant pulse oximetry, temperature monitoring, maintenance of sedation and analgesia, and protocol (used for RT to follow as consult), as well as labs, imaging, and stress ulcer prophylaxis order set. Order this for every patient newly intubated.

• Ventilator Management – Input vent mode, FiO2, PEEP, and other required settings (such as TV, RR, delta). RT will frequently change this order as needed. Would ensure direct communication with RT if making an important vent change. This order is called “Mechanical ventilation” when part of order set.

• ECMO – ‘ECMO high flow’ is the ECMO order set, which includes the full ECMO setup, ECMO monitoring, and ECMO change.

• Adult Continuous Sedation & Paralysis” – order panel for sedation and paralytics.

• “Exubation” – Would discuss with RT timing of extubation and plan for post-intubation oxygen support.

• “Keep prone” – A nurse order for prone patients, there is a “specialty bed (aka PRONE POSITION)” order but we do not have extra prone beds at this time.

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Helpful Links
Surviving Sepsis Campaign COVID-19 Guidelines

This document was created by the Division of Pulmonary, Critical Care, and Sleep Medicine at Brown University and may be updated or replaced with the next COVID-19 infection update. It is intended for educational purposes only and should not be interpreted as medical advice. Patients with known or suspected COVID-19 are recommended to consult with their primary care provider or hospital-based medical service for guidance on treatment and management of COVID-19.